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2018 年 02 月 9 日
Year Month Day

学 位 （ 博 士 ） 論 文 要 旨
(Doctoral thesis abstract)

論文提出者 Ph. D. Candidate	生物システム応用科学府 生物機能システム科学 専攻 博士後期課程 第１ 専修/グループ(Department Course) 平成 27 年度入学(Your Entrance Fiscal Year) 氏名 FERRY FAIZAL ㊞ (Your Name(Family, First) and Seal)				
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論文題目 Title	FORMATION OF MICROSTRUCTURED-PARTICLE LAYERS ON SUBSTRATE BY DEPOSITION OF SPRAYED AEROSOLS （エアロゾルの集積による基板上の微細構造粒子層の形成）				

The aerosol sprays have been applied to develop the particle layers and particles dispersion on the substrate. The methods have the flexibility to enhance the properties of the microstructure such as the morphology, dispersion uniformity and size distribution. However, in the spray method, there are several aspects to be concerned which influence the spray processes and the properties of the product. The main concerns are the particle generation, transport, and post-deposition treatment. Particle generation relates to the size distribution of the aerosol particles and their natural properties. Meanwhile, during the transport, the aerosol particles interact with external forces. Post-deposition treatment affects the final properties of the microstructured layer. In the present study, effects of the several forces will be investigated. The dynamic of the spraying condition was controlled by tuning the forces balance in the deposition chamber/domain. Some experimental work was supported by numerical simulation to determine the parameter and describe the phenomena.

In Chapter 1, using a heated (few hundred degree Celsius) plate substrate and ultrasonic-sprayed micron size droplets of the precursor solution, it was shown that the morphologies and crystallite size of metal oxide (ZnO) layers were influenced by the different level of thermal convection forces. The flow dynamics and temperature distribution were evaluated by numerical simulation. The presence of the thermal convection was directly affected the deposition amount of particle on the substrate. The result shows that there is an efficient route to obtain nanometer-sized particles by the breakage mechanism of micron size droplet.

In Chapter 2, the deposition of soot particle from the candle combustion was investigated. The soot particle was collected by exposing the collection substrate into the flame at the different air flow rate supplied from the bottom of the reactor chamber. The collected soot was refluxed into suspension and deposited by using electrospray-made charged aerosol droplets as the carrier. The result shows that soot particle layers can preserve hydrophobic state after the spray process. The flow rate of the air affected the ratio of the G-band and D-band in the Raman spectrum. Through the experiment, it was shown that the electrospray method was able to control and tune the optical properties of the soot layer.

submicron fluorescent particles were deposited on a heated (few ten degree Celsius) substrate. The force balance between carrier gas, drag forces, and gravity was elaborated by numerical simulation. By the approach of the dense population aerosol, the submicron particles were deposited. The correlation between apparent (fluorescent-based) size distribution and aggregate size obtained by mass balance calculation reveals that the present analytical approaches can be applied as the alternative to high-resolution vacuum imaging (e.g., SEM) in analyzing submicron order dispersed particles.

In Chapter 4, experimental work was performed to investigate the effect of the external electric field used in the electrospray method to the surface charge (positive and negative) of colloidal particles. Under the combination of positive or negative spray modes with positive or negative zeta potentials, silica particles were deposited on the substrates. The result showed distinctive morphologies and structural color, verified by the optical spectrums, size distribution, and inter-particle distance distribution.

The results above indicated that controlling the forces which involved in the spray process is beneficial to enhance the microstructure and size-dependent properties of the particle layers. Therefore the deposition of the particle via spray routes has potential application in the development of electronic, optical material and imaging technique of the particle on the biological substrate.

(英訳) ※和文要旨の場合(300 words)
If the abstract is written in Japanese, needed to translate into English.(300 words)